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designs also varies and may require multiple fabrication steps. For example, cuff/elastic gatherer combinations require the creation of both a cuff and an elastic gatherer which must be separately applied and which must be engineered to work together. "T"-shaped cuffs generally require additional engineering and manufacturing expense to place a "T"-shaped elasticized gasket upon a distal edge of a cuff. In an alternate design that is disclosed in U.S. Patent No. 5,643,243 to Klemp, a diaper is provided with elasticized unitary cuffs. Each unitary cuff includes multiple strands of elastic material and provides the sole elasticizing means for containing waste within the crotch region of the diaper.

Many of these diapers and other garments are also designed with an hourglass contoured shape which improves the fit and comfort of the diaper. A disadvantage of such contoured garments is that their design generally requires the use of complex high precision machinery to form necessary intricate shapes, thereby significantly increasing the production cost associated with the garment. Moreover, many of these garments are formed from rectangular absorbent articles, typically cut in assembly line fashion from moving webs. To form a garment from such a rectangular piece of absorbent material, material is typically cut away from the longitudinal edges of the absorbent article and discarded during formation of the leg holes. While such contoured garments generally provide a more comfortable fit, these garments may be prone to leakage along the edges of the contoured region.

SUMMARY OF THE INVENTION

It is one of several features and objects of the present invention to provide an improved disposable absorbent article.

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5 further example, a tab structure having hook structures may be attached to the ears 18 of the waist region 14 and made securable to loop members found on the front waist region 12. Such a "hook and loop" concept (and other generally known fastening structures) is generally known and practiced in the art and may be incorporated into the present invention design by one skilled in the art having access to the disclosure provided herein.

10 The diaper 10 of the present invention also features one or more longitudinally stretchable elastic members or leg elastics 32 positioned adjacent each of the two side edges 90 of the diaper 10 (see FIG. 3). When the diaper 10 is properly worn by the wearer, each leg elastic 32 encircles a leg of the wearer and provides a quasi-seal thereabout which substantially prevents leakage from the interior of the diaper 10. Such leg elastics 32 may be applied in the stretched or
15 extended condition. In one application of the invention, the elastics 32 are placed between the topsheet 50 and the backsheet 40 in the stretched condition, and, then, attached to one or both of the sheets 50, 40 (i.e., by glue or other adhesive). When subsequently released, the elastics 32 retract and form barrier cuffs, gathered leg regions or leg gatherers 36 as it pulls adjacent material therewith (see also FIGS. 1 and 2).

20 Now referring primarily to the exploded view of FIG. 3, a diaper 10 according to the invention typically features two to five layers. These five layers include a non-woven backsheet 40, a film barrier 42, a fluffed core 46, a topsheet 50, and a pair of end strips or tensioner members 80 disposed above the topsheet 50. FIG. 4 provides a cross-sectional view that depicts all five layers and their
25 respective structural relationships. In an alternative embodiment, the diaper 10 may include an acquisition layer disposed between the core 46 and the topsheet 50 (such a construction is described in more detail below). In yet another embodiment, the inventive diaper may utilize a multipurpose material as one of

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the layers (which provides multiple functions). In this way, the number of layers that is required may be reduced, and, in some embodiments, a thinner diaper structure results.

5 The tensioner member or tensioner 80 is preferably a single piece elastic strip having an outside end edge 82a, an inside end edge 82b, and a pair of opposite side edges 82c. As shown in FIGS. 2 and 4, the tensioner 80 is disposed over the surface of the topsheet 50 such that the outside end edge 82a is secured adjacent (e.g., aligned with) the end edge 92 of the diaper 10 (i.e., at each of the front waist region 12 and the back waist region 14). In the embodiment of FIGS. 10 1-4, the tensioner 80 generally extends transversely between the ears 18, i.e., from adjacent one side edge 90 of the diaper 10 to adjacent the opposite side edge 90. Along the longitudinal direction, the tensioner 80 extends inwardly from adjacent end edge 92 toward the crotch region 16 and just over the area of the core 46 (at 15 an angle direction spaced from the core 46 and topsheet 50). Thus, the tensioner 80 occupies a substantial portion of the front waist region 12 or back waist region 14 except in the ear regions 18.

20 The tensioner 80 may be formed from elastic film, foam, a combination of non-woven material and a stretchable film that is laminated together or a combination of two or more of these materials or laminate. The tensioner 80 may also be formed from a non-woven material with elastic strands or elastic non-woven material. In one suitable construction, the tensioner is formed primarily from an open cell polyurethane foam available from General Foam of Paramus, 25 New Jersey. In yet another suitable construction, the tensioner is formed from an elastic apertured film available from Tredegar Industries of Cincinnati, Ohio.

30 The tensioner 80 is preferably comprised of at least three distinct sections: a fixed elasticized section 80a (not shown in FIGS.) preferably secured adjacent one of the end edges 92

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5 tensioner 80 to the top sheet 50 or other subsurface layer. The size and number of
apertures 80 are determined so as to prevent unnecessary weakening of the
tensioner 80 and to guard against propagation of tears in the de-elasticized section
80b. Alternatively, de-elasticization is achieved by a heat deformation process
10 which de-elasticizes the elastic material by applying heat on the targeted material
before application of the tensioner 80 to the topsheet 50 or other subsurface layer.
In other embodiments, de-elasticization is achieved by the addition of stiffening
materials at the targeted area. In further embodiments, other methods of de-
elasticization known to those skilled in the art are utilized. One advantage
15 provided by the existence of a de-elasticized or non-elastic section is that the end
strip can have elastic properties, but the tendency of waist regions to contract (i.e.,
in the longitudinal direction) or crumple up is minimized.

20 It should be noted that the de-elasticized section 80b and the fixed section
80a are referred to herein as two sections of the tensioner 80 (e.g., a waist section
of the tensioner 80) only for descriptive purposes. However, in the embodiment
depicted in FIGS. 1-4, the fixed elastic section 80a and the fixed de-elasticized
section 80b are formed from the same elastic material and differ only in that the
de-elasticized section 80b has been applied and configured with the apertures 98.
25 In alternative embodiments, these two sections may, indeed, differ substantially
structurally and/or from a manufacturing standpoint.

30 Absent of voids or apertures, the soffit section 80c of the diaper 10
depicted in the drawings retains the strength and elasticity of the elastic material
from which the tensioner 80 is formed. The soffit section 80c may also be
referred to as the inward section of the tensioner 80. In Figures 1-4, the soffit
section 80c is also formed from the same elastic material from which the fixed
elastic section 80a and the fixed de-elasticized section 80b are formed. The soffit
section 80c extends inwardly from the de-elasticized section 80b and upwardly

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(i.e., at an angle) away from the topsheet 50. As best shown in the cross sectional view of FIG. 4, the soffit section 80c extends inwardly to the extent that it is over a longitudinal edge portion 46a of the core 46.

5 In one aspect of the invention, substantially all of the central portion of the soffit section 80c is free from and is spaced from the top sheet 50, while the side portions or lateral edges of the soffit section 80c are secured to the top sheet 50 and the distal edges 36a of the leg gathers 36. As a result, the tensioner 80
10 functions to pull at least the intermediate portions of the side edges 90 or, more appropriately, the regions of the side edges 90 (including the leg gathers 36) upwardly (by applying a contractile force across the waist region 16). These side edge regions are biased or brought to and maintained in an upstanding position along the crotch region 16 (see, e.g., FIGS. 1 and 3), to form upright side wall structures or side walls. As will be further explained below, these upstanding
15 side walls perform a containment or sealing function, as well as enhance the fit and comfort of the diaper 10.

As best shown in FIG. 1, the diaper 10 takes on an hourglass shape that is particularly advantageous to the fit and sealing ability of the diaper 10. This fit is
20 further enhanced by the upstanding disposition of the barrier cuffs or leg gathers 36 (i.e., side walls) and the tension provided in the front and back waist regions 12, 14 by the tensioner 80. Another advantage provided by the inventive diaper design is that the hourglass shape of the diaper may be attained without having to cut leg openings into the composite web structure during the manufacturing
25 process.

In yet another aspect of the invention, the combination of the upstanding side walls (including the barrier cuffs or leg gathers 36) and the elasticized soffit section 80c on both the front waist region 12 and the back waist region 14 of the

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diaper 10 creates a retention compartment or containment pocket 96 at the crotch section region 16. This retention compartment 96 is generally deeper than conventional containment or central core areas. The retention compartment 96 may be characterized as having a depth dimension generally equal to the vertical distance CC or the vertical distance between the inward edge 80d and the average elevation of the top surface of the core 46. This depth dimension CC is generally greater than about 1/4" and up to about 4", but preferably will be between 3/4" and 2" (as measured when the diaper 10 is in the flat, extended condition). The upstanding leg gathers 36 or side edge regions serve as one set of retaining sidewalls for the retention compartment 96 while the oppositely-facing elasticized soffit sections 80c serve as retaining end walls of the retention compartment 96. The elasticized soffit sections 80c are, in one regard, particularly adapted to provide such a function because it extends upwardly and well above the core 46. Thus, the retention compartment 96 may be referred to as having at least two elastic wall sections 80c and at least two intermediate wall sections 36 each disposed between elastic wall sections 80c. In alternative embodiments, the wall sections 36, 80c may be disposed in other areas of the article 10. The relatively deep retention compartment 96 of the present invention provides an improved structure and means for receiving and retaining body exudates in the central portion of the diaper 10. It should be noted, however, that the design of a deep retention compartment 96 is also applicable and advantageous in other disposable articles or garments 10.

In alternative embodiments of the present invention, the end strip may consist of more or less than three distinct sections. Further, the sections of the end strip may not be necessarily formed from the same material. Further yet, the end strip may be formed integrally as one piece with the topsheet or may include a portion of the topsheet. Additionally, the end strip may not necessarily be disposed adjacent the end edges and, in partially forming a containment wall of a

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between the topsheet 50 and the backsheet 40. The core 46 is preferably made from any one of several compositions (known in the art) which are adapted to absorb bodily liquids received through the topsheet 50. For example, the absorbent core may include a fluffed wood pulp component which provides wicking capability and structural integrity, and a high absorbency material (e.g., super absorbent) for containing liquids. The core may also include additional additives to provide other specific properties such as baking soda to provide improved odor absorbency. It should be noted, however, that the disposable absorbent article 10, according to the invention, is adapted to utilize absorbing cores of varying shapes and compositions.

Many absorbent cores known in the art are comprised of two components: a high absorbency material (or super absorbent material) and an absorbent composite. As expected, the majority of the volume of such an article (i.e., bulkiness) is due to the composite. The high absorbency material may be one of numerous compounds. A suitable material may include inorganic materials such as polyvinyl alcohol, polyacrylates, various grafted starches, and cross linked polysodiumacrylate. Further, the high absorbency material may be manufactured and utilized in the diaper in numerous forms including, but not limited to, particles, fibers, foams, and layers. On the other hand, the absorbent composite is generally a composite material such as a defiberized fiber, or a wood pulp.

Another relatively new material for core composition is the "MicroThin Absorbent Composite" under the "MegaThin" brand name. This material has been developed by Japan Absorbent Technology Institute of Japan. The material is a composite of SAP (superabsorbent polymer), MFC (microfibrillated cellulose) and non-woven which is characterized by its lighteners, thinners and softeners. See PCT Application PCT/JP97/04606, which is hereby incorporated by reference.

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5 An application of any such material to the present structure according to the invention will be apparent to a person skilled in the art. In addition, the specific structural configuration of the disposable absorbent article of the invention may also be manipulated to enhance absorbency (e.g., channels or grooves may be created to ultimately disperse liquid waste received in the deep containment).

Optional Layers

10 The disposable absorbent article according to the invention may contain additional layers including an acquisition layer or surge layer, preferably situated between the topsheet and the core. One function of such an acquisition layer is to spread out or disperse liquid flow so that liquid is distributed more evenly over the core surface. This serves to slow down the flow so that the liquid has adequate time to be absorbed by the core. The acquisition layer also serves to prevent the
15 core from being saturated locally, while a substantial remainder of the core is not absorbing any liquid.

Tape Tabs

20 The article must be secured to the wearer. This is most important with respect to diapers since they are not pulled upon the wearer, like training pants, or incontinent briefs, but are fastened around the wearer. The securing elements compliment the elastic members by effecting a quasi-seal between the wearer and the waist band and leg cuffs, so that liquid is contained within the article which is then absorbed; in other words, so that it does not leak through gaps between the
25 wearer and the edge of the article. The securing elements may be adhesive, mechanical fasteners, hook and loop features, or conceivably strings, i.e., anything that will secure one end of the article to the longitudinally opposite end.